IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Bampton et al.
Application No.:	10/732,882
Filing Date:	December 10, 2003
Group Art Unit:	1742
Examiner:	Ip, Sikyin
Title:	OXIDATION RESISTANT AND BURN RESISTANT COPPER METAL MATRIX COMPOSITES

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPEAL BRIEF

Dear Sir:

Appellant submits this corrected Appeal Brief pursuant to Decision on Petition mailed July 30, 2008. All appeal fees have been paid. Any additional fees or credits may be charged or applied to the Deposit Account 21-0279 in the name of United Technologies Corporation.

Real Party in Interest

The real party in interest is Pratt & Whitney Rocketdyne, Inc., assignee of the present invention.

Related Appeals and Interferences

There are no related appeals or interferences.

Status of Claims

Claims 11-17 and 35-42 were previously withdrawn from the application, and claims 4-10 were previously cancelled. Claims 1-3, 18-34, and 43-47 stand rejected and are appealed.

Status of Amendments

All amendments have been entered.

Summary of Claimed Subject Matter

Independent claim 1 is directed to an alloy in a metal matrix composite consisting essentially of about 2.5 to about 6 weight percent aluminum, about 30 to about 50 weight percent of nickel, about 3 to 30 weight percent of zinc, and the balance copper. [see specification page 5, lines 9-19]

Independent claim 18 is directed to a metal matrix composite material comprising a metal alloy consisting essentially of about 3 to about 6 weight percent aluminum, about 15 to about 45 weight percent of zinc, the balance of the alloy copper, and a reinforcing agent selectively disposed within the alloy. [see specification page 5, lines 9-19; page 6, lines 3-18]

Independent claim 27 is directed to a rocket engine component including a metal matrix composite comprising a metal alloy having a threshold burn resistant pressure greater than about 5,000 pounds per square inch, a reinforcement agent, and a bonding promoter adapted to promote an adhesion between said metal alloy and said reinforcement agent. [see specification page 11, lines 3 through page 15, line 2; page 15, lines 6-7; page 16, line 18 to page 17, line 9]

Independent claim 43 is directed to an alloy in a metal matrix composite consisting essentially of about 2.5 to about 6 weight percent aluminum, about 30 to about 50 weight percent of nickel, about 3 to 30 weight percent of zinc, and the balance copper, wherein the metal matrix includes a reinforcement agent. [see specification page 5, lines 9-19; page 6, lines 3-18]

Independent claim 47 is directed to a metal matrix composite consisting of about 2.5 to about 6 weight percent aluminum, about 30 to about 50 weight percent nickel, about 3 to 30 weight percent zinc, up to about 7 weight percent of at least one element selected from silicon, chromium, titanium, or combinations thereof, and a balance of copper, and reinforcing fibers

within the metal matrix, the reinforcing fibers consisting of at least one material selected from metal oxide, carbide, or combinations thereof. [see specification page 5, lines 9-19; page 8, lines 6-20; page 6, lines 16-18]

Grounds of Rejection to be Reviewed on Appeal

I. Whether claims 20 and 47 are properly rejected under the written description requirement of 35 U.S.C. §112, first paragraph.

II. Whether claims 1-3, 18-34, and 43-47 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 5,972,070 to Kondoh (hereafter "Kondoh").

III. Whether claims 1-3, 18-34, and 43-46 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 5,004,581 to Takagi (hereafter "Takagi").

IV. Whether claims 18-34 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 5,114,468 to Akutsu (hereafter "Akutsu").

Argument

I. Rejection of claims 20 and 47 under §112, first paragraph

The Examiner argues that the limitation "up to about 7 weight percent" of silicon, chromium, titanium, or combinations thereof in claims 20 and 47 does not have literal support in the specification. The test for support is whether the Appellant was in possession of the claimed invention as a whole. Respectfully, the subject application discloses numerous example compositions over the claimed range of "up to about 7 weight percent" that demonstrate possession of the claimed limitation. For instance, the application discloses the range of 2-7wt% (see page 5, lines 17-19). The application also discloses other examples having 1wt% and 0.5wt% of the claimed elements (see page 11, Table I; and page 13, Table II). Therefore, one of ordinary skill in the art could reasonably conclude possession of the claimed range of "up to about 7 weight percent."

The Examiner also noted in the Advisory Action that there is no literal support for the range from 0-0.5wt%. However, the application discloses some compositions that do not include any silicon, chromium, or titanium (see page 13, Table II). Therefore, the specific examples

disclosing 2-7wt%, 1wt%, 0.5wt%, and 0wt% of silicon, chromium, or titanium support the claimed range of up to 7wt%. The rejection should therefore be withdrawn.

II. and III. Rejection of claims 1-3, 18-34, and 43-46 under §103(a) over Kondoh and Rejection of claims 1-3, 18-34, and 43-47 under §103(a) over Takagi

Claims 1, 18, and 43

The Examiner argues that that each of Takagi and Kondoh discloses the claimed composition. However, the "consisting essentially of" language of claims 1, 18, and 43 precluded the compositions of Takagi and Kondoh. The Examiner argues that Appellant has not shown that introduction of the other elements in Takagi and Kondoh would materially change the characteristics of the composition. However, the elements of Takagi and Kondoh are not impurity elements and would therefore inherently influence the characteristics of an alloy. For instance, the iron (Fe) contributes to dispersion strengthening in the composition of Takagi (col.3, lines 31-34, lines 41-45). The element lead (Pb) in the composition of Kondoh influences lubricity (col. 3, lines 50-55; col. 9, lines 28-46). Appellant's composition is intended for burn and oxidation resistance, not lubricity and dispersion strengthening. Therefore, the additional elements of Takagi and Kondoh would change the fundamental character of Appellant's composition.

Additionally, Appellant submitted evidence of an article from "Flammability and Sensitivity of Materials in Oxygen-Enriched Atmospheres" by Sinclair et. al. (hereafter the "Sinclair article") The Sinclair article studied the combustion behavior of elemental materials. Table 2 (p.104) in the Sinclair article illustrates threshold pressures at which complete combustion occurred. That is, a high pressure indicates good burn resistance and a low pressure indicates poor burn resistance. The additional elements iron (Fe) and lead (Pb) that are present in the compositions of Takagi or Kondoh are detrimental to burn resistance based on the Sinclair article. For instance, the Sinclair article concludes that elements such as cobalt (Co), nickel (Ni), and copper (Cu) (see p.103) are burn resistant. In Table 2, cobalt (Co), nickel (Ni), and copper (Cu) have threshold pressures greater than 69MPa. However, the elements iron (Fe) and lead

(Pb) that are present in the compositions of Takagi and Kondoh have respective threshold pressures of 0.5MPa and 5.2MPa that are much lower than the burn resistant elements. Therefore, iron (Fe) and lead (Pb) are detrimental to burn resistance, and inclusion of iron (Fe) and lead (Pb) into the claimed composition would materially change the burn characteristics. Accordingly, Takagi and Kondoh do not teach the claimed composition and the claims should be allowed.

Additionally, the Examiner responded in the Advisory Action that iron (Fe) is in the same group as cobalt (Co) and nickel (Ni) and that copper (Cu) is the balancing element in the claimed composition. The Examiner therefore appears to be suggesting that the negative influence on burn resistance from iron (Fe) would be offset by the positive influence of copper (Cu). However, the issue here is simply whether the other elements in Takagi and Kondoh materially influence burn resistance. Iron (Fe) is not present in the claimed composition. Sinclair suggests that iron (Fe) would negatively influence burn resistance. Therefore, there is a likelihood that adding iron (Fe) to the claimed composition would materially influence burn resistance.

Claim 26

Claim 26 recites that a reinforcing agent is a present in the metal matrix composite material in a range of "about 55 to about 85 volume percent." The Examiner argues that the Kondoh reference discloses an overlapping range with the claimed range because the matrix (i.e., the copper alloy friction material) of Kondoh could be interpreted as a reinforcing agent. Respectfully, the matrix of Kondoh cannot be interpreted as a reinforcing agent. The matrix includes copper alloy friction material for providing lubricity. Hard particles dispersed within the copper alloy function as an adjusting agent relative to the copper alloy for influencing the strength and hardness of the copper alloy (col.2, lines 5-17; col.6, lines 66-67). Thus, in the composition of Kondoh, the hard particles are the reinforcing agent via influencing the strength of the copper alloy. Therefore, interpreting the matrix as a reinforcing agent is contrary to the explicit teachings of the Kondoh reference.

The Examiner further argues in the Advisory Action that Appellant failed to define "reinforcing agent" and that the claimed reinforcing agent can therefore read on the matrix of

Kondoh. However, such as interpretation is overly broad and ignores the self-evident meaning of the term "reinforcing agent." By the plain meaning of the term, a reinforcing agent, at the very least, is a material added to another material to reinforce the other material. The matrix of Kondoh is neither an additive nor a reinforcement to another material. In fact, hard particles are added to the matrix to reinforce the matrix. For these reasons, claim 26 is allowable.

Claim 27

The Examiner argues that the claimed composition overlaps the composition of the claimed references, and that the reference composition would therefore inherently have the claimed burn resistance. In the Advisory Action, the Examiner suggests that because the claimed metal alloy, reinforcement agent, and bonding promoter overlap the compositions of the cited references, the reference compositions would inherently have the claimed burn resistance. Respectfully, the Examiner's reasoning is flawed. The burden is on the Examiner to establish inherency, and the burden is on the Examiner to show that the reference compositions would inevitably or invariably always have the claimed burn resistance. In this case, as evidenced by the Sinclair article discussed above, not all compositions are burn resistant. Therefore, the reference compositions would not automatically have the claimed burn resistance. For this reason, the rejection fails to establish inherency and claim 27 is allowable.

Claim 47

Claim 47 recites a composition "consisting of" certain compositional constituents. The Examiner does not appear to have considered that the "consisting of" language closes the claim to the specified elements except for impurities ordinarily associated therewith. The rejection does not establish that the additional element(s) present in the compositions of Kondoh are impurities that would ordinarily be present in the amounts disclosed. For at least this reason, claim 47 is allowable.

IV. Rejection of claims 18-34 under §103(a) over Akutsu

The Examiner argues that that Akutsu discloses the claimed composition. However, the Examiner has overlooked the "consisting essentially of" language of claims 18-34 and argues that Appellant has not shown that introduction of the other elements would materially change the characteristics of the composition. In this case, the composition of Akutsu includes oxygen. The oxygen influences wear resistance by forming hard oxides (see col.2, lines 39-45). Appellant's composition is intended for oxidation resistance. Therefore, the oxygen of Akutsu would change the fundamental character of Appellant's composition by promoting rather than resisting oxidation. Claim 18 and its dependent claims are allowable.

Claim 26

Additionally, the rejection of claim 26 should be withdrawn because the Akutsu reference also does not disclose an amount of reinforcing agent that overlaps the claimed amount of reinforcing agent of "about 55 to about 85 volume percent." Akutsu discloses at most 15 vol% (col.1, lines 63-65) of reinforcing agent.

Claim 27

Additionally, the rejection of claim 27 should be withdrawn for the same reasons stated above under section II and III that the Examiner has failed to establish inherency.

CLOSING

For the reasons set forth above, the final rejection of claims 1-3, 18-34, and 43-47 is improper and must be reversed.

Respectfully submitted,

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CLAIMS APPENDIX

1. An alloy in a metal matrix composite construct having a high burn and oxidation resistance consisting essentially of:

about 2.5 to about 6 weight percent aluminum;
about 30 to about 50 weight percent of nickel;
about 3 to 30 weight percent of zinc; and
the balance copper.

2. The alloy of claim 1, further consisting of a material selected from the group consisting of silicon, chromium, titanium, and combinations thereof.

3. The alloy of claim 2, wherein the material selected from the group consisting of silicon, chromium, titanium, and combinations thereof, is present in an amount of about 2 to about 6 weight percent.

18. A metal matrix composite material comprising:
a metal alloy consisting essentially of:
about 3 to about 6 weight percent aluminum;
about 15 to about 45 weight percent of zinc;
the balance of the alloy copper; and
a reinforcing agent selectively disposed within said alloy.

19. The metal matrix composite material according to claim 18, wherein said alloy consists further of a material selected from the group consisting of silicon, chromium, titanium, and combinations thereof. unimportant

20. The metal matrix composite material according to claim 19, wherein the material selected from the group consisting of silicon, chromium, titanium, and combinations thereof, is present in an amount up to about 7 weight percent.

21. The metal matrix composite material according to claim 18, wherein said reinforcing agent is a fiber having a first dimension greater than a second dimension.

22. The metal matrix composite material according to claim 21; wherein said first dimension is about 8 to about 20 micrometers.

23. The metal matrix composite material according to claim 21, wherein said second dimension is substantially equivalent to a dimension of a construct formed with said alloy.

24. The metal matrix composite material according to claim 18, wherein the reinforcing agent is a material selected from the group consisting of alumina, silicon carbide, carbon, and combinations thereof.

25. The metal matrix composite material according to claim 18, wherein the reinforcing agent is a present in the metal matrix composite material in the range of about 15 to about 70 volume percent.

26. The metal matrix composite material according to claim 18, wherein the reinforcing agent is a present in the metal matrix composite material in the range of about 55 to about 85 volume percent.

27. An oxygen-rich environment rocket engine component including a metal matrix composite, the metal matrix composite comprising:

a metal alloy having a threshold burn resistant pressure greater than about 5,000 pounds per square inch;

a reinforcement agent; and

a bonding promoter adapted to promote an adhesion between said metal alloy and said reinforcement agent.

28. The oxygen-rich environment rocket engine component of claim 27, wherein said metal alloy comprises:

about 2.5 to about 6 weight percent aluminum;

about 3 to about 30 weight percent nickel;

about 3 to about 30 weight percent zinc; and

copper.

29. The oxygen-rich environment rocket engine component of claim 27, wherein said bonding promoter comprises a material selected from the groups consisting of silicon, chromium, titanium, and combinations thereof.

30. The oxygen-rich environment rocket engine component of claim 29, wherein said bonding promoter is about 2 to about 7 weight percent of said metal alloy.

31. The oxygen-rich environment rocket engine component of claim 27, wherein said reinforcing agent is the material selected from a group consisting of ceramic particles, ceramic whiskers, ceramic fibers, or combinations thereof.

32. The oxygen-rich environment rocket engine component of claim 27, wherein said reinforcing agent is a material selected from the group consisting of alumina, silicon, carbide, and combinations thereof.

33. The oxygen-rich environment rocket engine component of claim 27, wherein said reinforcing agent is about 15 to about 70 percent of the volume of the metal matrix composite.

34. The oxygen-rich environment rocket engine component of claim 27, wherein said metal alloy and said bonding promoter are pressure injected into said reinforcement agent.

43. An alloy in a metal matrix composite construct having a high burn and oxidation resistance consisting essentially of:

about 2.5 to about 6 weight percent aluminum;
about 30 to about 50 weight percent of nickel;
about 3 to 30 weight percent of zinc; and
the balance copper;
wherein the metal matrix includes a reinforcement agent.

44. The alloy of claim 43, further consisting of a material selected from the group consisting of silicon, chromium, titanium, and combinations thereof.

45. The alloy of claim 43, wherein the material selected from the group consisting of silicon, chromium, titanium, and combinations thereof, is present in an amount of about 2 to about 6 weight percent.

46. The alloy of claim 43, wherein said reinforcing agent is a material selected from the group consisting of alumina, silicon, carbide, and combinations thereof.

47. A metal matrix composite having a high burn and oxidation resistance, consisting of:

a metal matrix having about 2.5 to about 6 weight percent aluminum, about 30 to about 50 weight percent nickel, about 3 to 30 weight percent zinc, up to about 7 weight percent of at least one element selected from silicon, chromium, titanium, or combinations thereof, and a balance of copper, and

reinforcing fibers within the metal matrix, the reinforcing fibers consisting of at least one material selected from metal oxide, carbide, or combinations thereof.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.